

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
19 May 2005 (19.05.2005)

PCT

(10) International Publication Number  
**WO 2005/045884 A2**

(51) International Patent Classification<sup>7</sup>: **H01L**  
(21) International Application Number:  
PCT/IL2004/001027

(22) International Filing Date:  
10 November 2004 (10.11.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/518,341 10 November 2003 (10.11.2003) US  
60/606,468 2 September 2004 (02.09.2004) US

(71) Applicant (for all designated States except US): **RAMOT AT TEL-AVIV UNIVERSITY LTD.** [IL/IL]; 32 Haim Levanon St., P.O.Box 39296, IL-61392 Tel Aviv (IL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **RUSCHIN, Shlomo** [IL/IL]; A.D. Gordon Street 33, IL-46433 Herzlia (IL). **STEPANOV, Stanislav** [IL/IL]; 34/23 Einstein St., IL-69101 Tel Aviv (IL).

(74) Agent: **FRIEDMAN, Mark**; 7 Jabotinsky St., IL-52520 Ramat Gan (IL).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

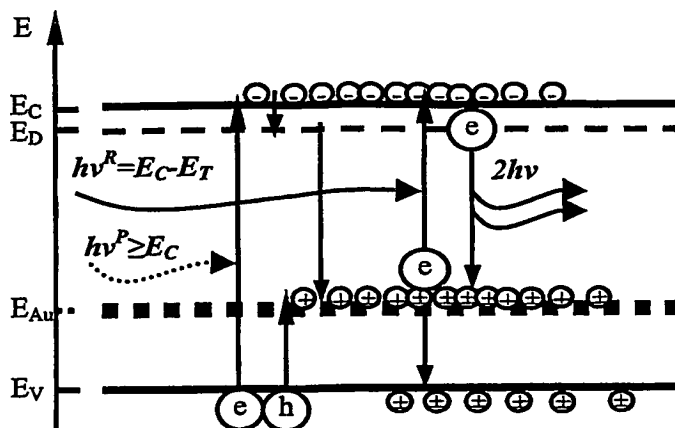
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: APPARATUS AND METHODS FOR OPTICAL AMPLIFICATION IN SEMICONDUCTORS



(57) Abstract: Methods and corresponding apparatus for optical amplification in semiconductors, particularly indirect band-gap semiconductors, and most particularly in silicon. A first aspect of the invention employs certain doping elements to provide inter-band-gap energy levels in combination with optical or current-injection pumping. The doping element, preferably a noble metal and most preferably Gold, is chosen to provide an energy level which enables an energy transition corresponding to a photon of wavelength equal to the signal wavelength to be amplified. The energy transition may be finely "adjusted" by use of standard doping techniques (such as n-type or p-type doping) to alter the conduction and valence band energy levels and thereby also the magnitude of the energy

transition. A second aspect of the invention relates to the use of a non-homogeneous heat distribution which has been found to lead to optical amplification effects.